

**S.P. Cramer & Associates, Inc.**

Fisheries Consultants  
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97 JUL 28 PM 2:04

July 26, 1998

Kate Hansel  
CALFED Bay-Delta Program  
1416 Ninth Street, Suite 1155  
Sacramento, CA 95814

Dear Kate:

Enclosed are 10 copies of our second proposal for consideration of Category III funding.

Respectfully,

Steven P. Cramer

cc Rick Barzan (OID)  
Rick Martin (SSJID)  
Steve Emrick (attorney)  
Tim O'Laughlin (attorney)  
Woody Trihey  
Doug Demko

## I. EXECUTIVE SUMMARY

DWR WASHINGTON

97 JUL 28 PM 2:04

### **Determine the Feasibility of Alternative Restoration Measures to Reduce the High Mortality of Chinook Smolts Within the Stanislaus River.**

**APPLICANT:** Steven P. Cramer, S.P. Cramer & Associates, Inc.

#### **PROJECT DESCRIPTION & OBJECTIVES:**

This project will investigate the probable location and causes of high mortality to juvenile chinook as they migrate from the Stanislaus River, and will identify alternative restoration measures to overcome those causes. Catches of chinook smolts in rotary-screw traps at two locations in 1996 indicated that the majority of smolts did not reach the downstream trap, 34 miles distant. Before taking hit-or-miss remedial action, we need to determine the location and probable causes of this high mortality. Findings from the project proposed here would complement ongoing studies of chinook outmigration in the Stanislaus River funded by USFWS, South San Joaquin ID, and Oakdale ID.

The project has three objectives: (1) Estimate mortality and migration rates of chinook smolts between Oakdale (RM 40) and Caswell (RM 6) on the Stanislaus River, (2) determine the rates and locations at which noteworthy events occur to the radio-tagged fish, and (3) identify alternative restoration measures to improve smolt survival within the Stanislaus River and describe factors affecting their implementation and effectiveness.

#### **APPROACH/TASKS/SCHEDULE:**

We will use radio tagging to track individual chinook smolts and determine their behavior, migration rate, and location of mortality within the lower 40 miles of the Stanislaus River. Radio tracking provides the quickest and surest method for identifying where fish are dying, and what the probable causes may be. We will tag and release up to 50 chinook smolts > 105 mm fork length in the vicinity of Oakdale and track them to Caswell State Park (RM 6). We will release 10-15 radio-tagged fish in each of four tests spaced at about 10 day intervals. The test fish will be naturally-produced smolts, > 105 mm long, captured in the Oakdale trap. Daily detections by mobile tracking will be used to determine the spatial distribution of tags each day, changes in migration rate during the day, and locations of mortality. We will also place fixed receivers midway between the two traps and at the Caswell trap. Locations at which migration halts or the signal is lost will be recorded.

#### **JUSTIFICATION:**

There is substantial uncertainty and controversy regarding the limiting factors to salmon production in the Stanislaus Basin. This project will provide answers to one of the most troubling questions, "Where do all of the chinook smolts disappear to between

Oakdale (RM 40) and Caswell (RM 6)?" This project will greatly reduce the uncertainty about potential benefits of restoration projects proposed to remove or reduce predators. The project will also identify alternative habitat restoration opportunities in the lower Stanislaus Basin to address the causes of smolt mortality. The project focuses on two priority habitats and a priority fish species identified by CALFED.

**BUDGET & THIRD PARTY IMPACTS:** Total project costs are \$109,418 of which 25% will be contributed by OID and SSJID. No third party impacts are anticipated.

**QUALIFICATIONS:** Key personnel will be Senior Fisheries Consultant, Steven P. Cramer, and Fishery Biologist Douglas B. Demko. Mr. Cramer (23 years as a professional) and Mr. Demko have been leading studies of fall chinook and rainbow/steelhead in the Stanislaus River for the last 5 years. Mr. Cramer will oversee project and complete much of the analysis. Mr. Demko will lead the field studies.

**MONITORING AND DATA EVALUATION:** Our study protocol and our draft final report will be reviewed by three qualified peers agreeable to CALFED.

**LOCAL SUPPORT & COORDINATION WITH OTHER PROGRAMS:** The need to identify and remedy the causes of poor smolt survival in the Stanislaus River has been identified by the Stanislaus Stakeholders Group, and 25% cofunding is offered by the two largest water right holders in the basin, Oakdale ID and South San Joaquin ID. This study will substantially boost the interpretive power of ongoing studies funded by USFWS, OID, SSJID, and Stockton East WD.

## II. TITLE PAGE

### **Determine the Feasibility of Alternative Restoration Measures to Reduce the High Mortality of Chinook Smolts Within the Stanislaus River.**

**APPLICANT:** Steven P. Cramer  
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Gresham, OR 97080  
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email: spcramer@teleport.com

**Type of Organization and Tax Status:** Fisheries Consultants, Corporation  
**Tax ID Number:** 93-1055956

**Technical and Financial Contact persons:**  
Steven P. Cramer at above location

Douglas B. Demko  
2504 Navarro Dr.  
Chico, CA 95926  
Phone: 916-342-9262(voice), 916-898-0956(fax)  
Email: demko@dcs-chico.com

**Collaborators:** South San Joaquin Irrigation District  
Rick Martin, Manager  
11011 E Highway 120  
Manteca, CA 95336  
209-823-3101

Oakdale Irrigation District  
Rick Barzan, Acting Manager  
1205 East F Street  
Oakdale, CA 95361  
209-847-0341

**RFP Project Type:** Other Services

### **III. PROJECT DESCRIPTION**

#### **PROJECT DESCRIPTION AND APPROACH**

We will use radio tagging to track individual chinook smolts and determine their behavior, migration rate, and location of mortality within the lower 40 miles of the Stanislaus River. Recovery rates of traditionally marked smolts have been too low to enable accurate determination of mortality rates through the lower river, but estimates of total smolt abundance at two points in the river indicate the majority of smolts die before reaching the river mouth (Figure 1). Radio tracking provides the quickest and surest method for identifying where and how fast fish are dying. A relatively small number of radio-tagged fish can provide more information than 10-times the number of conventionally tagged or marked fish. We will release 50 radio-tagged smolts in small groups (10-15) at different flows and actively track the fish as they migrate downstream following release. Fish that die or are eaten can be readily identified, because they cease to migrate downstream. We will track fish with a combination of mobile and fixed receivers to determine where mortality occurs, and what proportion of fish survive to pass specific points. Findings about where and when mortality occurs will reveal the types of remedial action that may be appropriate, as well as those that would accomplish little.

#### **PROJECT LOCATION**

The project area is the Stanislaus River from its confluence with the San Joaquin River, upstream 40 miles to Oakdale. Oakdale is near the lower limit of fall chinook spawning and rearing.

#### **EXPECTED BENEFITS**

Radio tracking provides the quickest and surest method for identifying where fish are dying, and what the probable causes may be. Focused remedial action can then be taken. The pattern of mortalities, by time of day and river mile, will provide strong clues as to the causes of mortality. If predation is the principal problem, this can be easily identified when a tagged fish begins an entirely new pattern of movements, compared to those of a migrating smolt. If there are specific areas where mortality is concentrated, these will be identified. This project will greatly reduce the uncertainty about potential benefits of restoration projects proposed to remove or reduce predators. Because we will gain new clues to locations and probable causes of mortality, we will be able to identify habitat restoration opportunities that address those causes where they occur.

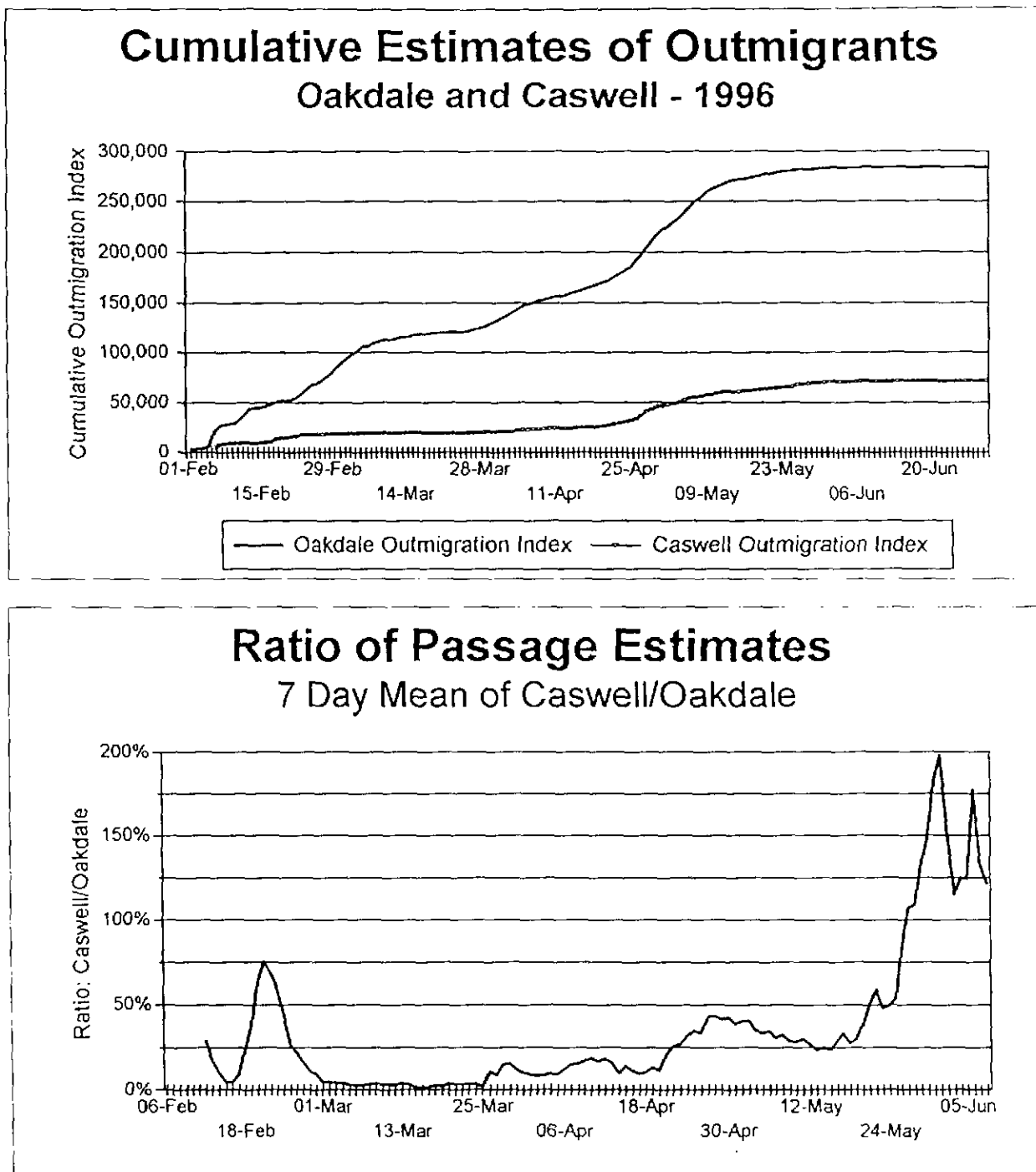


Figure 1. Cumulative estimates of outmigrants passing Oakdale and Caswell during 1996, and the ratio of Caswell:Oakdale for the 7-day running average of chinook passage. From Demko, D.B. and S.P. Cramer. 1996. Effects of pulse flows on juvenile chinook migration in the Stanislaus River. S.P. Cramer & Associates, Inc., Annual Report to South San Joaquin and Oakdale Irrigation Districts, Manteca and Oakdale, California.

## **BACKGROUND AND BIOLOGICAL JUSTIFICATION**

Mortality of out-migrating juvenile chinook occurs at unusually high levels within the Stanislaus River, but the causes are unknown. During 1996, the number of out-migrating chinook were estimated at two points (City of Oakdale and Caswell State Park) 34 miles apart, and only 40% of smolts passing the upstream site during the peak of outmigration (April 25 to May 10) were accounted for at the downstream site. Prior to the peak migration, generally less than 15% of outmigrants were accounted for, except for fry during a brief period in mid-February, when turbidity was high and flow increased sharply. Before taking hit-or-miss remedial action, we need to determine the location and probable causes of this high mortality. Conventional marking techniques have produced too few recaptures between the two trapping locations to yield much information on factors influencing smolt survival. A new method of tracking juvenile chinook is needed to identify where they are dying, and to verify that present methods of estimating survival are reasonable.

Radio-tagging of chinook smolts has been used extensively in the Columbia River Basin in recent years, and has provided important new information on smolt behavior as they pass specific areas, locations of high mortality, and causes of mortality. These studies have primarily used fish greater than 105 mm fork length, and tests in the Snake River indicated those fish were tagged without altering their behavior (personal communication, D. Rondorf, NBS, Cook WA). Although the average length of smolts in the San Joaquin Basin is usually less than 105 mm, individuals of this size are abundant during the peak outmigration from mid April to mid May. It may also be possible to radio tag fish smaller than 105 mm in the San Joaquin Basin, because Lotek Engineering has developed a tag that is smaller (6.8 mm x 12 mm weighing 0.5 g in water) than the tag used in the Snake and Columbia rivers (7.3 mm x 18 mm weighing 0.8 g in water).

## **PROPOSED SCOPE OF WORK**

### **Objective 1.            Estimate Mortality and Migration Rates of Chinook Smolts Between Oakdale (RM 40) and Caswell (RM 6) on the Stanislaus River.**

An independent estimate of survival, and of fish behaviors that may have influenced that survival, is urgently needed to validate results from studies with the rotary screw traps. Full sampling of rotary screw traps at both Oakdale (funded by SSJID and OID) and Caswell (funded by AFRP) is planned for 1998. The difference in estimated smolt passage at the two traps indicates the majority of fish do not survive the migration between the two points, but many doubt the accuracy and cause of that finding. In the project proposed here, we will tag and release up to 50 chinook smolts > 105 mm fork length in the vicinity of Oakdale and track them to Caswell State Park (RM 6). The test fish will be naturally-produced smolts captured in the Oakdale trap. We will follow the fish with mobile tracking, as well as fixed receivers midway between the two traps and at the Caswell trap.

Locations at which migration halts or the signal is lost will be recorded.

The sampling described here fit within the technological limitations of the radio tagging and tracking techniques. These limiting factors include:

- fish length greater than 105 mm (somewhat smaller with beeper tag)
- dependable battery life is 12 days at 40 beats/minute
- water conductivity is less than 1,000 ms
- receiver scan time of 5 seconds per tag within detection range (limits number of tags passing simultaneously that can be tracked by single receiver)
- maximum depth of detection is 10 m
- detection range is 150 m for fish 2 m deep in water

Because of the small size of the Stanislaus River and the absence of salinity, the above limitations should be of minimal consequence. Recaptures of marked smolts between the two rotary screw traps indicate that most fish migrate the distance in less than one week.

In the event that some smolts take longer than 12 days to reach Caswell, their batteries are likely to run out. However, tracking strategies will be worked out to insure that all fish are accounted for at the start and end of each day, so the proportion that remain above Caswell when the batteries run out can be determined. Fish whose batteries run out before reaching Caswell should be a small percentage of the total survivors, and their eventual survival to Caswell can be estimated based on their migration rate and the mortality rate per day.

Radio tracking would enable evaluation of fish behavior as they pass the sampling sites so that behaviors likely to influence capture efficiency in the traps can be identified. Such behaviors might include shore orientation or movement during day light. If smolts preferred to migrate near shore only during certain times of day or under certain conditions, they would be less vulnerable to capture by trap during these times, but more vulnerable at other times. If fish move during the day, the trap catches could be biased by lower capture efficiency during day light.

## **Objective 2 Determine the rates and locations at which noteworthy events occur to the radio-tagged fish.**

Questions to be answered include, Where did mortality occur? When did mortality occur? How did migration rate vary with time, location, and river conditions? We will track tagged fish 16-24 hours per day by boat and road to be sure that we determine where and when key events occur. Events of interest would be a change in migration rate, and death. Experience with radio tracking chinook smolts in the Columbia River has show that free swimming smolts are quickly and easily differentiated from those that have been eaten by



predators (personal communication, J. Snelling, Oregon State University, Corvallis). Tagged fish eaten by predators will still be detectable, but the migratory pathway of the tag will change sharply. The location at which tagged fish are first detected to have been eaten will be logged.

Radio-tracking studies with chinook smolts in the Columbia River have demonstrated that maximum information can be obtained by using a mobile tracking unit mounted in a boat, and operating throughout daylight. The unique purpose here will be to determine the rate and location at which noteworthy events occur, and the proportions of fish that can be expected to arrive in specific locations within an approximate time frame. Fixed-station data loggers will also be tested at two sites and the number of fish detected as they pass will be compared to the number detected by continuous tracking from a boat and car. Daily detections by mobile tracking will be used to determine the spatial distribution of tags each day, changes in migration rate during the day, and locations of mortality.

Naturally-produced smolts will be tagged with a radio transmitter inserted into their stomach, and held for 24 hours in a live cage to allow recovery before being released. Tagged fish will be released beginning 2-3 hours before dawn in groups of 2-3 fish spaced at 5 minute intervals. The intention of the times identified here is to keep tagged fish from following each other and to release them during darkness when there is less danger of immediate predation as they orient themselves. We will release 10-15 radio-tagged fish in each of four tests spaced at about 10 day intervals.

**Objective 3 Identify alternative restoration measures to improve smolt survival within the Stanislaus River and describe factors affecting their implementation and effectiveness.**

Once we have identified where and under what conditions the smolts are most vulnerable to mortality, appropriate courses of remedial action can be identified. Of particular interest is whether there are specific areas of high predation rate, high entrainment rate, or effluent drains that impair survival. If mortality is highly disperse, than large expenditures to remove areas of predator concentration may be unwarranted. The opposite may be true as well.

**Deliverables:**

1. Monthly progress summaries consisting of 1-2 page narrative accompanied by pertinent summary tables or graphs.
2. Monthly invoices showing daily schedule of time invested by each worker and all expenses.
3. Final Report. This report will fully document our methods, results and findings. All data will be presented in tabular summaries, and important relationships will be illustrated with graphs and photographs. The report will first be submitted as a draft,

and then revised to final form, based on comments received.

## **MONITORING AND DATA EVALUATION**

Our sampling protocol will be reviewed by three qualified peers prior to implementation, and our final report will similarly be reviewed by three peers. We will provide full explanation of how we use the comments received from these reviewers. Reviewers will be selected at the discretion of CALFED, and we will offer names of qualified reviewers for CALFED consideration.

## **IMPLEMENTABILITY**

- (1) We already have sampling permits from CDFG for the fish that will be radio tagged, and the fish are being captured by studies funded from other sources.
- (2) Even if fall chinook should be listed under the federal ESA, the small number of fish to be tagged makes this an especially attractive method for studying listed species.
- (3) We have determined from sampling in the Stanislaus River at Oakdale (RM 40) that smolts large enough for radio tagging are common, and that the methods used are highly successful in the Columbia River Basin.
- (4) The two major water right holders in the basin are offering financial support for this work.

## IV. COSTS AND SCHEDULE

### BUDGET

This is a new project that is not being proposed to other funding sources, nor are there any plans to fund this work outside of the CALFED process. As an outcome of this project, desirable restoration projects will be identified, but they will be separate from this project and can be considered independently for funding. Because the specific restoration projects are unknown at this time, we have no estimate of costs for those projects.

The Oakdale and South San Joaquin Irrigation Districts have committed to fund 25% of this project, if the remaining 75% is funded by CALFED. Full costs are displayed in the following table, according to the CALFED format. The following budget includes two fixed station receivers, one mobile receiver, and three antennas.

Task	Personnel	Labor Hours	Direct Salary & Benefits	Overhead Labor	Service Contracts	Supplies	Misc. Direct Costs	Total Cost
<b>Objective 1. Estimate Smolt Mortality</b>								
	Senior Consultant (Cramer)	60	\$2,455	\$2,825				
	Fish Biologist (Demko)	200	\$4,836	\$5,564				
	Fisheries Technician	300	\$2,074	\$3,326				
	Database Specialist	80	\$1,215	\$1,585				
	Subtotal		\$10,580	\$13,300	\$0	\$26,000	\$2,500	\$52,380
<b>Objective 2. Determine Where and When Mortality Occurs</b>								
	Senior Consultant (Cramer)	30	\$1,228	\$1,412				
	Fish Biologist (Demko)	200	\$4,836	\$5,564				
	Fisheries Technician	300	\$2,074	\$3,326				
	Database Specialist	80	\$1,215	\$1,585				
	Subtotal		\$9,352	\$11,888	\$0	\$6,500	\$4,500	\$32,240
<b>Objective 3. Identify Restoration Alternatives</b>								
	Senior Consultant (Cramer)	16	\$655	\$753				
	Fish Biologist (Demko)	60	\$1,451	\$1,669				
	Project Administrator/Support	20	\$304	\$396				
	Subtotal		\$2,409	\$2,819	\$0	\$0	\$200	\$5,428
<b>Report Preparation</b>								
	Senior Consultant (Cramer)	80	\$3,274	\$3,766				
	Fish Biologist (Demko)	60	\$1,451	\$1,669				
	Statistician	80		\$510	\$5,100			
	Project Administrator/Support	60	\$911	\$1,189				
	Subtotal		\$5,636	\$7,134	\$5,100	\$500	\$1,000	\$19,370
<b>PROJECT TOTAL</b>			<b>\$27,978</b>	<b>\$35,140</b>	<b>\$5,100</b>	<b>\$33,000</b>	<b>\$8,200</b>	<b>\$109,418</b>

There is likely to be additional questions to answer after the first year of study, so it would be prudent to expect 2 years of study. Radio tracking equipment (\$22,600) would only be purchased in the first year, but radio tags (\$165 each) would be purchased each year. Manpower requirements should be expected to remain the same.

## **SCHEDULE MILESTONES**

Following is the expected schedule for completing work on major segments of this project. Where a range of dates are given, the first date is the starting time, and the second date is the completion time. These dates assume that the contract will be in place by January 1, 1998.

Jan-March 1998	Complete operational plan for field studies, and order radio tags and tracking units.
March 1998	Prepare and test field gear.
April-May 1998	Complete Radio Tracking
June-Aug 1998	Compile and Analyze Data
Oct 1998	Submit Draft Report
Dec1999	Submit Final Report

Invoices will be submitted monthly for actual time and expenses invested. Invoices will be accompanied by a written summary of progress. About 90% of the project and its expenses should be completed in 1998, and 10% in 1999.

## **THIRD PARTY IMPACTS**

We do not foresee any impacts to third parties.

## V. QUALIFICATIONS

Our project leader will be Senior Fisheries Consultant, Steven P. Cramer, and he will be supported by Fishery Biologist Douglas B. Demko. Mr. Cramer will oversee project implementation, lead the experimental design, data analysis, and serve as lead editor for the final report. Mr. Demko will lead the field operations with two fisheries technicians, synthesize the data gathered from those studies, and coauthor the final report. Additional support can be drawn from the expert staffs of S.P. Cramer & Associates. Our senior consultants, fisheries technicians and computer applications experts are highly qualified, experienced, and specifically trained in the tasks they assist with.

A portion of our funding for studies on the Stanislaus River over the past several years has come from the AFRP, administered through the Stockton office of the USFWS. Please contact Pat Brandes, Sam Lohr, or Marty Kjelson (916-946-6400) regarding our performance. For additional references, contact the managers of the two irrigation districts offering cofunding on this project (see title page for names and phone numbers).

### **Steven P. Cramer, Principal, S.P. Cramer & Associates, Inc.**

Steven P. Cramer has been a fisheries consultant to private firms, state and federal agencies, and Indian tribes for the past 10 years after serving 13 years with the Oregon Department of Fish and Wildlife (ODFW) where he directed major research programs on the Rogue and Columbia basins. The focus of his research and consulting has been the population dynamics of salmon and steelhead populations in the western United States. Mr. Cramer has designed and supervised studies of juvenile chinook outmigration from the Stanislaus River for the last 5 years. Additionally, he has led mark-recapture studies of smolt migration and survival in the Sacramento River, the Yuba River, the Rogue River, the Columbia River. He has been the lead author on reports presenting detailed analyses of limiting factors for Sacramento spring and late-fall chinook, Willamette River spring chinook, Snake River spring and fall chinook, steelhead in all California and Oregon, and coho in all Oregon. For 12 years, he led studies by ODFW to determine downstream effects on fish from temperature and flow alteration by dams in the Rogue River Basin. He has authored over 70 distributed reports relating to the dynamics of salmon and steelhead populations. For further details, see our web site at [www.spcramer.com](http://www.spcramer.com).

### **Douglas B. Demko, Fisheries Biologist, S.P. Cramer & Associates, Inc.**

Doug Demko has served as a Fisheries Biologist with S.P. Cramer & Associates for 7 years, including 5 years that he has led field studies of anadromous salmonids in the Stanislaus River. He has worked closely with state and federal biologists in the Stanislaus Basin, and has conducted spawner surveys, snorkel surveys of juvenile rearing, mark-recapture studies of juvenile chinook survival, and outmigrant trapping studies in the Stanislaus River. He has also been the field crew leader for mark-recapture studies of

smolt migration and survival in the Sacramento River and the Yuba River. He has been the crew leader of fish habitat surveys on the Big Quilcene River in Washington (US Forest Service), and of snorkel surveys of fish abundance and habitat use in the Umpqua River in Oregon (Douglas County), and three streams on the Thousand Springs Ranch near Mt. Shasta. Mr. Demko has authored numerous reports distributed to public agencies. For further details, see our web site at [www.spcramer.com](http://www.spcramer.com).

## **VI. COMPLIANCE WITH STANDARD TERMS AND CONDITIONS**

We accept the terms and conditions specified in the RFP.